

Effect of Alcohol on the Sexual Reflexes of Normal and Neurotic Male Dogs

W. HORSLEY GANTT, M.D.

SHAKESPEARE is still the chief authority for the effect of alcohol on sexual activity. Thus in one of the best known pharmacological texts (7) of today the only evidence adduced under the heading *Ethyl alcohol: sexual functions* is this quotation from Macbeth: "Macduff: What three things does drink especially provoke? Porter: Marry, sir, nose-painting, sleep, and urine. Lechery, sir, it provokes, and unprovokes; it provokes the desire, but it takes away the performance." Besides the quotation there are only two sentences devoted to the subject "sexual functions" in sixteen pages on ethyl alcohol. Most other pharmacological texts omit any reference to the action of alcohol on sexual reflexes.

Apparently no experimental work has been done on the subject; for in fourteen leading texts on pharmacology and Heffter's *Handbuch* there is no other reference than that to Shakespeare, and one to Havelock Ellis.¹ Notwithstanding the mass of physiological details accumulated in the numerous studies of alcohol, there is an amazing vacuity of objective data regarding the influence of this universal beverage and drug on sexual behavior. This no doubt results from the lack of an adequate method as well as the mystery, confusion, and taboos with which sexual questions are enshrouded. Thus my own original studies on the appearance of abnormal sexual erections

in the neurotic dog Nick and on the production of artificial sexual reflexes as a method of studying sexual reactions met with vehement disapproval from an eminent source.

Previous investigations of this laboratory concerned the effect of alcohol on the cortical and subcortical salivary reflexes (conditional and unconditional) in both dog (4) and human (3). Partly to complete the former study of the action of alcohol on the integrated reflexes and partly for the elaboration of the question of sexual reactions in neuroses, the present investigation was undertaken.

Method

Sexual reflexes were artificially induced² in 5 male dogs, all of whom had been previously used in the laboratory for studies in motor or salivary conditional reflexes. The dogs were used only three days in the week, rest days intervening to avoid any possibility of sexual exhaustion. On alternate experimental days alcohol was given one-half to one hour before the induction of the sexual reflexes to include the period of maximum action of the alcohol. In one week there were thus two alcohol experiments and one control and in the next week there were two control and one alcohol experiment. The items chosen for recording were the latent period of ejaculation, the latent period of erection, the duration of erection (measured from the beginning of the stimulation of the genitalia).

The results presented below are from the

From the Pavlovian Laboratory, Phipps Clinic, Johns Hopkins University.

¹ That no research has been done and that Shakespeare's observations are the basis for the pharmacological knowledge concerning the action of this universal drug on the sexual activity reminds us that many fields of medicine are still unexplored.

My hearty thanks are due to Dr. E. K. Marshall for his counsel in these experiments.

Received for publication January 22, 1951.

² The most satisfactory method for the production of artificial sexual reflexes is the application of faradic or manual stimulation to the external genitalia for a constant length of time, usually one minute in our experiments.

five dogs, Sechs, Ephraim, Nick, Billy, Parsifal.

Sechs, age about 6, a large, friendly, placid, police type dog, had been employed in the laboratory three to four years for the study of salivary conditional reflexes. Ephraim, age about 4-6 years, also a large, friendly dog, but very excitable and active, might be considered a chronic alcoholic as he had been given large doses of alcohol daily for a year,

after which he had about six months' rest without alcohol before the present experiments. Nick, about 7-9 years of age, was an extremely hyperactive dog with a marked "experimental neurosis," and pathological sexual erections. Billy, age 10-12, a stable, friendly (though aggressive to other dogs) American pit bull terrier, had been working in the laboratory since 1931 on various conditional reflex problems and had been previously

TABLE 1. SUMMARY OF RESULTS

Dog:wt.	Dates of experiments	Without alcohol (control)			With alcohol		
		Onset ejac. (l.p.)	Onset erect. (l.p.)	Durat. erect.	Onset ejac. (l.p.)	Onset erect. (l.p.)	Durat. erect.
SMALL DOSE 0.5 CC. PER KG. BODY WEIGHT							
Sechs 22.5 Kg.	Alcohol (11 cc.), March 15, 20, 24 Control, March 3, 17, 22	20"	30"	4'	26.67"	38.34"	3.34
Ephraim 13.5 Kg.	Alcohol (6.75 cc.), March 15, 24, 24 Control, March 17, 22	None	57"	5'	None	55"	2'
Nick 16 Kg. (neurotic)	Alcohol (8 cc.), April 21, 26; May 3, 10, 15, 19, 24, 26; June 5, 12 Control, April 24; May 2, 8, 12, 17, 22, 26; June 2, 7, 19	10.3"	26"	11'	12.4"	30"	9.34'
Aver. (median)		15"	30"	5'	19.5"	38"	3.3'
MODERATE DOSE 1.0 CC. PER KG. BODY WEIGHT							
Sechs	Alcohol (22 cc.), March 1, 6, 10 Control, February 27; March 3, 8	15"	30"	4.83'	23.34"	43.34"	3.8'
Ephraim	Alcohol (13.5 cc.), March 1, 6, 10 Control, March 3, 8, 13	50"	50"	3.03'	None	None	None
Nick (neurotic)	Alcohol (13 cc.), March 29; April 3 Control, March 31; April 5	14"	32"	11.5'	32"	45"	3.5'
	Alcohol (16 cc.), July 20 Control, July 18, 22	14"	25"	12'	None	None	None
Parsifal 23 Kg.	Alcohol (23 cc.), April 21, 26; May 3, 10, 15, 19, 24, 31; June 5, 12 Control, April 19, 24; May 1, 8, 12, 17, 22, 26; June 2, 7, 12	14.6"	46.7"	5.67'	15"	49.25"	4.5'
Aver. (median)		14.6"	32"	5.7'	32"	49.2"	4.5'

TABLE 1—(Continued)

Dog:wt.	Dates of experiments	Without alcohol (control)			With alcohol		
		Onset ejac. (l.p.)	Onset erect. (l.p.)	Durat. erect.	Onset ejac. (l.p.)	Onset erect. (l.p.)	Durat. erect.
LARGE DOSE 2.0 CC. PER KG. BODY WEIGHT							
Sechs	Alcohol (45 cc.), February 8, 17, 24 Control, February 6, 15, 20	15"	32"	4.17'	None	None	None
Ephraim	Alcohol (27 cc.), February 8, 17, 24 Control, January 30; February 1, 3, 6, 15, 20, 27	49"	53"	3.7'	None	None	None
Nick (neurotic)	Alcohol (32 cc.), March 10; May 17, 19; June 22, 29; July 1, 15 Control, May 23, 25, 27, 30; July 1, 15	13"	30"	11.5'	None	None	None
Billy 16 Kg.	Alcohol (32 cc.), April 24; May 1, 8, 12, 17, 22, 26; June 27; July 1, 8, 13, 18 Control, April 21, 26; May 3, 10, 15, 19, 24, 31; June 24, 29; July 6, 11, 15, 22	9"	25"	4.6'	11.2"	29.2"	3.05'
Parsifal	Alcohol (46 cc.), March 29; April 3, 10, 18 Control, March 27, 31; April 5, 14, 19	None	46"	6.8'	None	51"	None
Aver. (median)		15"	32"	4.6'	None	None	None
"CATATONIC" DOG (IMPOTENTIA)							
V3	Alcohol (25 cc.), November 1950				None	40"	38'
13 Kg.	Control, October 1950	None	None	None			

studied for the effect of alcohol on salivary conditional reflexes. In contrast to Nick, he was the most stable of all our dogs. Parsifal was a young dog, about 3 years old, of the same type as Sechs, but he had not been used in the laboratory previously.

Small, moderate, and large doses, viz., 0.5 cc., 1.0 cc., and 2.0 cc. per Kg. body weight of ethyl alcohol in milk diluted to about 20 per cent alcohol, were administered to the dogs, who would usually drink the mixture with some coaxing; if they refused, it was diluted with milk to 10 per cent alcohol content, and if they still refused, the alcohol mixture was introduced through a stomach tube. Altogether there were, including controls, 31 experiments with the small dose, 40

experiments with the moderate, and 63 experiments with the large dose of alcohol.

Results

The results set forth in detail in Table 1 and the accompanying charts³ (Figs. 1-5)

³ Figures 1 and 2 show the complete abolition of sexual reflexes with the large doses, and a very slight decrease in duration with the moderate and small doses. Figure 3 shows in the neurotic dog Nick a marked increase in sexual reflexes on the days following the first large dose of alcohol, and the continued prolongation of the duration of sexual reflexes with abolition of sexual reflexes on alcohol days (June, July). After an interval of nine months without alcohol the sexual reflexes had dropped again to normal, but the duration of the erection

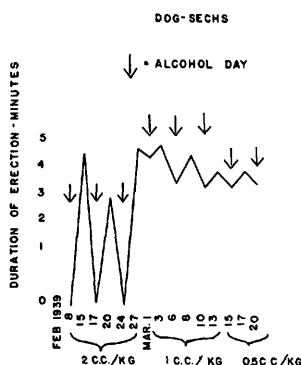


FIG. 1. Effect of alcohol on sexual reflexes in an old dog.

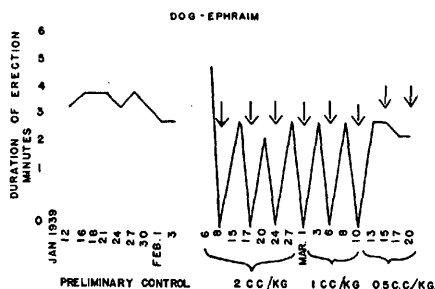


FIG. 2. Effect of alcohol on sexual reflexes in an alcoholic dog.

show unequivocally that the tendency of alcohol in any dose is to delay the onset of ejaculation and to shorten the duration of erection, and that this is in proportion to the amount of alcohol. The large dose abolished all the external manifestations of the sexual reflexes except in Billy and Parsifal and ejacu-

again increased with the resumption of alcohol administration. Figure 4 in the dog Billy shows no marked difference in the duration of sexual reflexes whether the dog was inside or outside the experimental room. There is a decrease but not abolition of the sexual reflexes with the large dose of alcohol but very little change with the moderate dose. Figure 5 in the dog Parsifal reveals only a very slight decrease of sexual erection even after the administration of the large doses of alcohol.

lation in all except Parsifal; the small dose showed only a slight delay in the onset of erection (41 seconds control latent period to 46 seconds with alcohol), a slight shortening of the duration of erection (2.9 minutes control to 2.5 minutes with alcohol), and no effect on the beginning of ejaculation. The moderate dose (1.0 cc. per Kg. body weight) was intermediate in its effect. The latent period of ejaculation was lengthened from the control of 14.5 seconds to 25 seconds with alcohol, the latent period of erection from 29 seconds to 39 seconds, and the duration of erection shortened from 7.8 minutes to 5.2 minutes (average of all experiments).

In the charts there is evident a tendency of alcohol to cause an increase of the sexual reflexes on the control days in those dogs in

whom controls were also run before the beginning of the alcohol experiments, slight in the stable dog Billy, but very marked in the neurotic dog Nick (Figs. 3, 4).

Discussion

Previously I showed that alcohol had a depressing effect on both cortical and subcortical reflexes as measured by the conditional and unconditional salivary reflexes (4), causing in small doses, an increase in latent period, both motor and salivary, and in larger doses also a marked decrease of the intensity of the conditional reflexes and, to a less extent, of the unconditional reflexes. Differenti-

crease with practice, it seems safe to assume that the reflexes measured and recorded here are more similar to the unconditional reflexes in the Pavlovian terminology. Occasionally a conditional sexual reflex appeared after some of the dogs had been repeatedly used in the laboratory, but the reflex was extremely weak compared with the food- or pain-conditioned reflexes (crs).

Whether or not these sexual reflexes are purely unconditional reflexes, the results here are in agreement with the previous experi-

Notwithstanding this uniform action of alcohol in all doses, a marked difference exists in the susceptibility of various dogs, a susceptibility that is in conformity to the temperament or constitutional reactivity of the animal. The least effect of alcohol was seen in Parsifal, a young dog (Fig. 5), with little experience in the laboratory and in Billy, an old dog (Fig. 4), who had worked in the laboratory for eight years. Both of these animals were stable in their behavior; much data have been accumulated on Billy to show that he was

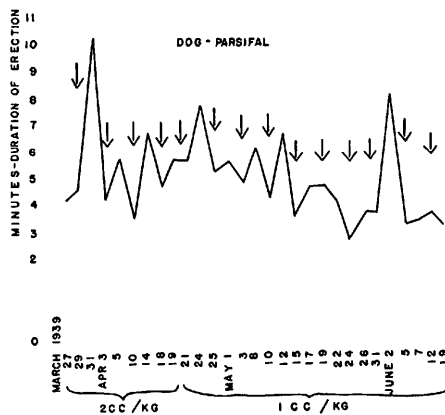


Fig. 5. Effect of alcohol on sexual reflexes in a stable young dog.

ments from this laboratory on alcohol: the effect of alcohol on both motor⁴ and salivary conditional and unconditional reflexes, on sexual reflexes as well as on food reflexes is always that of a depressant during the peak of the effect of the concentration in the blood. The uniformity of the action, no matter what dose of alcohol was used, made it seem unlikely that different stages of absorption or of concentration in the blood stream would prove exceptions to the above rule.

⁴That is, the latent period is lengthened and differentiation impaired. Actually there may be increased activity both secretory and motor but not to the proper conditional stimulus.

stable constitutionally in all his observable behavior. On the other hand the most susceptible animals were Nick and Ephraim. The results in Nick, an animal with persistent neurotic symptoms lasting most of his life (12 years) as described elsewhere (5) were most unusual. He received doses of alcohol in June and July, 1938, and in April, May, and June, 1939. As with the other dogs there was a delayed effect on the onset of ejaculation and a shortening of the duration of erection with the small doses and complete inhibition of sexual reflexes with the larger doses. With 1 cc. of alcohol per Kg. body weight the latent period of the onset of erection in

creased from 30 seconds (control) to 35 seconds (alcohol) and the duration of erection decreased from 11.5 minutes (control) to 6.7 minutes (alcohol). The most remarkable effect was seen in Nick after administration of a single large dose of alcohol on May 17, 1938. Although on the day that the alcohol was given the sexual reflexes were inhibited as noted above, on the alternate days they were markedly prolonged as shown in Fig. 3. The sexual erection was increased from a normal average of 3 minutes to about 12 minutes on the day after alcohol.

Ephraim was an excitable dog and a chronic alcoholic, having had large daily doses for a year. To draw conclusions concerning chronic alcoholism from the one dog Ephraim is unwarranted, but it is well to mention that the small doses of alcohol had the most marked effect on this animal in shortening the duration of erection. In the previous experiments with alcohol (5) it was found that the unstable dogs were more affected and the stable the least affected. The most unstable in the former series was an anatomically pathological animal with half of his cortex removed.

Alcohol was used in two psychopathological animals of opposite types. The first dog, Nick,⁵ had an anxiety-like neurosis of long standing; he was hyperactive, sociable, and showed frequent pathological erections and ejaculatio praecox. The premature erections and ejaculations were corrected somewhat by small doses of alcohol.

The second dog, V3, was a very shy fearful animal about three years old, reared in the laboratory. After months of handling, he persisted in running away from all the people who worked with him as well as from others, in spite of there being no history of mistreatment.⁶ When put into the experimental Camera he became practically cataleptic, and often fell to the floor, as if in an hysterical

seizure. During these attacks he exhibited *cera flexibilitas*, allowing his limbs to be put into various unnatural postures. Although absolutely no sexual erections could be induced by peripheral stimulation in this dog before alcohol, after a dose of 2 cc. of alcohol per Kg. body weight, he showed a spontaneous erection when brought near the Camera and on peripheral genital stimulation he had a partial erection (without ejaculation and orgasm) lasting for 37 minutes. This dose is large enough to inhibit sexual erection in normal dogs, but in this extremely pathological animal, the most persistently neurotic of any dog we have had, erections appeared for the first time.

In spite of the favorable action of alcohol on these two opposite types, neither one of the dogs would voluntarily drink the alcohol (diluted in milk to 10%), in contrast to Masserman's self-selecting-therapy cats.

Thus besides the dose, the constitution and past experience of the animal are most important factors in determining the effect of alcohol. The lengthening of the latent period of ejaculation and erection may be related to the diminished sensitivity to pain and other tactile stimuli produced by alcohol, especially with the large doses in which a state approaching anesthesia may ensue. On the other hand the impairment of differentiation with small doses of alcohol is apparently not due simply to diminished sensitivity, as it occurs between stimuli as different as visual and auditory. The intricate mechanism of the action of alcohol is as yet unsolved.

A patient who suffered from ejaculatio praecox, so that he would regularly have an ejaculation even before insertion, was able to overcome this by several glasses of wine or beer before coitus—in spite of the fact that he is a very excitable and anxious type.

The results of this study do not contradict the popular conception that alcohol increases desire but diminishes potency. Although desire cannot be subjectively recorded in the dogs, it is easily conceivable that alcohol, by changing the mood as well as the cortical discrimination, would render the individual susceptible to more varied stimuli to which he

⁵ For a complete description the reader is referred to the life history of Nick given in Gantt: *Experimental Basis for Neurotic Behavior* (5).

⁶ Collaborators in these experiments are Arthur Humphries and Youssef Mawardi. A complete account of this exceedingly interesting animal will be the subject of another paper.

would react in a less restrained way—lower the threshold—or that it would stimulate the sexual centers directly.

Although it is not the purpose of this paper to make clinical correlations, the following suggestion is ventured. By diminishing the sensitivity of the stimulation, removing inhibition and anxiety, and generally producing euphoria, at the same time lengthening the latent period of erection and ejaculation, alcohol may have a certain therapeutic value in psychic impotence as well as in ejaculatio praecox. The mechanism of this action now seems fairly clear. Subjectively, according to Shakespeare, as well as to his predecessors and successors, alcohol augments sexual desire. The increase in the threshold for genital tactile sensitivity, together with the lengthening of the latent period of complete erection, results in a delay of ejaculation and orgasm. The lengthening of the latent period of both conditional reflexes and unconditional reflexes other than the sexual is a general characteristic of alcohol (4). This delay, although representing a weakening of the reflex,⁷ would have a beneficial effect in ejaculatio praecox because it prolongs sexual activity before the onset of orgasm and ejaculation.⁸ The final result would be a more prolonged period of somewhat lessened sexual intensity. The dose of alcohol, the type of individual, the significance of alcohol for him, and especially the mood changes, would have to be carefully considered.

In conclusion I should like to point out the advantage for psychosomatic medicine of animal experimentation in the study of a subject such as alcohol and sexual behavior, which would be difficult to investigate experimentally in the human being. This point of view has been ably presented by Beach (1).

⁷ Dykman (2), Otterback and Gantt (8) have shown for both unconditioned reflexes and crs that latent period is a measure of intensity of the reflex.

⁸ It is well known that in the male the occurrence of orgasm tends to terminate sexual activity. But it has been shown in this laboratory that even with other reflexes (e.g., the salivary to food and the motor to pain) the onset of the appropriate ur terminates all preceding conditional activity relating to that reflex (6).

Summary

Alcohol in small, moderate, and large doses has a depressant effect on sexual reflexes in proportion to the dose. In the small dose this effect is to cause an increase in latent period of ejaculation and erection and shortening of the duration of erection; in large doses there is an unequivocal and complete abolishment of both ejaculation and erection. Its effect is not only, however, proportionate to the dose but is closely correlated with the constitution (including past history) of the dog. Its influence on sexual reflexes is fairly parallel to that on salivary and motor conditional and unconditional reflexes.

Not only does the influence of alcohol vary somewhat with the individual animal, but there is a marked difference in its action on the normal and on neurotic dogs. Thus in regulated doses it may have a therapeutic effect in impotentia sexualis and ejaculatio praecox, probably by diminishing genital sensitivity and increasing the latent period of complete erection and ejaculation.

References

1. BEACH, F. A.: "Psychosomatic" phenomena in animals. Lecture delivered at Cornell University, March 9, 1950, under the auspices of the Jacob Schiff Foundation.
2. DYKMAN, R. A., and GANTT, W. H.: A comparative study of cardiac and motor conditional responses. *Am. J. Physiol.* Vol. 167, No. 3, Dec. 1951.
3. FINKELSTEIN, N., ALPERN, E. B., and GANTT, W. H.: Amphetamine (benzedrine) sulfate upon higher nervous activity compared with alcohol: II. Human experiments. *Bull. Johns Hopkins Hosp.* 76: 61, 1945.
4. GANTT, W. H.: Effect of alcohol on cortical and subcortical activity measured by the conditioned reflex method. *Bull. Johns Hopkins Hosp.* 56: 61, 1935.
5. GANTT, W. H.: *Experimental Basis for Neurotic Behavior*. New York, Paul B. Hoeber, 1944.
6. GANTT, W. H.: Relation between unconditioned and conditioned reflex: Inhibition of conditioned reflex by unconditioned reflex. *Am. J. Physiol.* 133: 286, 1941.
7. GOODMAN, L., and GILMAN, A.: *The Pharmacological Basis of Therapeutics*. New York, The Macmillan Co., 1941.
8. OTTERBACK, VIRGINIA L., and GANTT, W. H.: Latent period as an index of intensity of the conditional reflex. *Federation Proc.* 6: 173, 1947.